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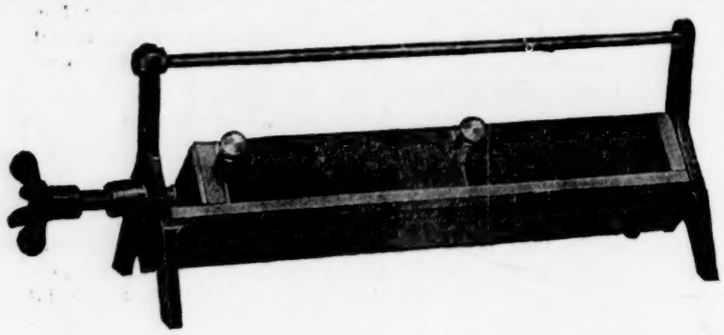

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GEOPHYSICS AT THE BRUSSELS MEETINGS, JULY 18–28, 1919[1]

UNDER the auspices of the International Research Council, which met at Brussels in the Palais des Académies, July 18–28, 1919, there was established, besides other international unions of astronomy, mathematics, physics, chemistry, biology, scientific radiotelegraphy, etc., the International Geodetic and Geophysical Union, consisting of the following sections and officers:

Since there were represented at Brussels this time only the countries of the Allies, it was concluded to defer complete organization of the sections until the entrance into the Union of other countries to be invited by the International Research Council. In the case of Section (*b*) (Seismology), since the agreement among nations belonging to the International Seismological Association, formed before the war, does not expire until April 1, 1920, it was necessary to postpone any organization, whatsoever, of the section. However, as the central office of the association is at Strasburg, it is fitting that it continue there when the Section of Seismology is organized. Professor E. Rothé has been appointed to the chair of geophysics, at the University of Strasburg, France. The rector of the university invited the delegates at Brussels to attend the opening, on November 11, 1919, of the university, now under French auspices.

The *Executive Committees of the Sections* were for the present limited to the president, vice-president and secretary, excepting in the case of (*e*) (Physical Oceanography) where Sir Charles Close (British Ordnance Survey)

[1] Basis of an account which the writer was requested to give before the combined meeting at Ann Arbor, September 4, 1919, of the American Astronomical Society, American Mathematical Society, and the Mathematical Association of America.

Section	President	Vice-President	Secretary and Director Central Bureau
a. Geodesy	William Bowie (U. S. Coast and Geodetic Survey)	Vincenzo Reina (Italian Geodetic Commission)	Lt. Col. G. Perrier (Army Geographic Service, Paris)
b. Seismology	Organization deferred		
c. Meteorology	Sir Napier Shaw (British Meteorological Office)	A. Angot (French Meteorological Bureau)	C. F. Marvin (U. S. Weather Bureau)
d. Terrestrial Magnetism and Electricity	A. Tanakadate (University of Tokyo)	Charles Chree (Kew Observatory)	Louis A. Bauer (Carnegie Department of Terrestrial Magnetism)
e. Physical Oceanography	.....	H. Lamb (University of Manchester)	G. P. Magrini (Hydrograpic Office, Venice)
f. Vulcanology	A. Riccò (Observatory Etna, Sicily)	H. S. Washington (Carnegie Geophysical Laboratory)	A. Malladra (Vesuvius Observatory)

and Mr. G. W. Littlehales (U. S. Hydrographic Office) were made additional members of the executive committee of that section.

The *officers of the International Union of Geodesy and Geophysics* are: President, M. Charles Lallemand (director, Levelling Service, France); general secretary, Colonel H. G. Lyons (Army Meteorological Service, Great Britain). These two officers, with the addition of the presidents of the Sections, who are the vice-presidents of the Union, constitute the *Executive Committee of the Union.*

According to the method of organization and the interpretation put upon the office of secretary, it is expected that the affairs of the unions and sections, between the triennial meetings of the General Assembly, will be largely conducted by the respective secretaries, as is the case also with regard to the general secretaryship of the International Research Council, to which Professor Arthur Schuster was reelected. Thus, according to the official or French version of the statutes of the Union, which were made to conform to those of the council, the secretary's duties are defined as follows:

> The secretary of a section shall act as director of its central bureau. He shall be responsible for the conduct of correspondence, the management of the resources, the custody of the documents, the preparation and issue of publications and such other matters as the General Assembly may refer to him.

Organization of Work.—In section (*a*) (Geodesy), which is to take the place of the former International Geodetic Association, it was decided to defer the appointment of committees and the organization of international research work in geodesy until the next general meeting (1922) of the Union, or until some previous special meeting. At a joint meeting of geophysicists and astronomers it was finally decided to leave to the International Astronomical Union the future international variation-of-latitude observations.

Section (*c*) (Meteorology) it was generally agreed could usefully and effectively supplement, by confining its work to research and fundamental problems in meteorology, the functions and work of the pre-war International Meteorological Committee. The latter, as it consisted of official weather-bureau directors, necessarily had to concern itself primarily with administrative and official meteorological questions. In the unavoidable absence of the elected president, Sir Napier Shaw, no organization of work was attempted except the passing of two resolutions to the following effect:

> (*a*) That there be appointed a Joint Committee of the International Astronomical Union and of the Section of Meteorology of the International Geodetic and Geophysical Union for investigational work on solar radiation.
>
> (*b*) That international work in atmospheric electricity, as far as possible, be placed under the direction of a committee nominated partly by the Section of Terrestrial Magnetism and Electricity and partly by the Section of Meteorology.

The work of section (*d*) (Terrestrial Magnetism and Electricity) could be more com-

pletely organized than that of the other sections, as it happened that there were present at Brussels six members of the pre-war International Magnetic Commission of the International Meteorological Committee, viz: Agnot (France), Bauer (U. S. A.), Chree (England), Palazzo (Italy), Schuster (England), and Tanakadate (Japan). After the election of the officers on July 24 and discussion of the status of work of the pre-war International Magnetic Commission, the following eight resolutions were passed:

1. That a committee be appointed to consider the best method of securing an adequate comparison of the magnetic instruments in use in different countries, and to consider as to the best method of measuring the magnetic elements in absolute units.

2. That the Section of Terrestrial Magnetism and Electricity concurs in the resolution of the Meteorological Section that international work in atmospheric electricity should be as far as possible placed under the direction of a committee nominated partly by the Section of Terrestrial Magnetism and Electricity, and partly by the Section of Meteorology.

3. That the Section of Terrestrial Magnetism and Electricity would welcome cooperation with the International Union of Scientific Radio-telegraphy in the investigation of the electric phenomena of the higher atmosphere.

4. That a committee be appointed on the systematic exchange of magnetic curves.

5. That special committees be appointed from time to time for the investigation and report on specific problems in terrestrial magnetism and electricity.

6. That the Section of Terrestrial Magnetism and Electricity would welcome cooperation with the International Astronomical Union in investigating the relationships between solar and terrestrial magnetic and electric phenomena.

7. That the ex-officio members of the executive committee be empowered to elect additional members to serve until the next ordinary meeting of the Union.

8. That the executive committee consult with the executive committees of other sections of the Union and report to the general secretary of the Union the amount of funds annually required by the Section during the period of the present convention.

The executive committee of the Section of Terrestrial Magnetism and Electricity on July 25, in order to carry into effect these resolutions, appointed ten committees, the complete composition of which was deferred until the entrance into the Union of other countries. Thus the committee-plan of distribution of international researches in terrestrial magnetism and electricity (atmospheric electricity, earth currents, polar lights, radiotelegraphy-strays, etc.), as adopted by the International Astronomical Union, was also followed in section (*d*) as, in fact, generally in the other sections, as far as they could be organized.

Annual Funds.—The basis of votes and financial contributions is that adopted by the International Research Council, viz:

Population of Countries	Number of Votes on Scientific Questions	Number of Units of Financial Contributions
Less than 5 millions	1	1
Between 5 and 10 millions..	2	2
Between 10 and 15 millions..	3	3
Between 15 and 20 millions..	4	5
Over 20 millions	5	8

Each country may include the native inhabitants of its colonies in its population. Self-governing dominions have a separate voting power according to above scale. It is expected that there will be at least fifty contributing units, hence, the total annual funds which may be available for the international researches of a Union will be about 50 times the unit of contribution, whatever that be finally. The funds are to be obtained, by the International Research Council, through a national research organization, academy, or governmental agency.

It is not possible under the present statutes, for a country to join only one or more of the sections of the Geodetic and Geophysical Union. In this respect, then, the organization of the new international associations (unions) differs from the pre-war ones—a country could join, for example, only the International Geodetic Association, not, necessarily, also the International Seismological Association. As a matter of fact, however,

practically all civilized countries were adherents of the various existing international bodies. Hence the aggregate money contribution per county joining the new international bodies will probably not be any more, more likely less, than under the old system.

The organization of the new international bodies may appear to be not as simple, or perhaps not even as independent, as the former ones. Thus, for example, instead of having such a brief and convenient name as "International Geodetic Association" we would have now "Section of Geodesy of the International Geodetic and Geophysical Union." (The International Research Council does not insist upon having its name also added.) Many of the geophysical delegates from the various represented countries, it appeared, would have preferred the name. "International Geophysical Union," in accordance with the original proposal. However the executive committee of the International Research Council, at its preliminary meeting in Paris last May, adopted the expanded name on the motion of the representative of Italy.

Most likely there will naturally come into use simplified designations, as, for example: International Geodetic Section (or committee), International Seismological Section (or committee), etc. This would conform to the corresponding names for the "national sections," as they have been tentatively called in the United States, or "national committees," as they are called in England and France.

The basic idea of retention of the name of section (or of committee) is, of course, that the particular branch of geophysics represented by the section is to be considered as but a part of the broad, general subject of geophysics. The fruitful, fundamental idea is that there will be at least once in three years a general symposium on the main branches of geophysics, rather than independent, uncoordinated meetings on special branches. In that respect there is certainly a great gain in the new organization of geophysical bodies over the old ones. And as far as independence is concerned, it is to be said that the manner of organization admits of much elasticity and large freedom of action of any section apart from the Union to which it may belong, or of the Union apart from the council.

The present convention is to continue for twelve years, beginning January 1, 1920, subject to renewal and modification at the end of this period. The general meetings are to take place every three years when there will be opportunity for changes in organization or statutes, as future experience may suggest. It will not be necessary for a union to meet at the same place as the council, or for all the various unions to meet together. A section may furthermore call a special meeting when found necessary.

The *objects of the International Geodetic and Geophysical Union* are stated in the official version as follows:

1. To promote the study of problems concerned with the figure and physics of the earth.
2. To initiate and coordinate researches which depend upon international cooperation and to provide for their scientific discussion and publication.
3. To facilitate special researches, such as the comparison of instruments used in different countries.

In conclusion, it may not be amiss to say that the six sections of the International Geodetic and Geophysical Union as finally established were in general accord with those the American Geophysical Delegates were instructed to recommend. The French had originally proposed but two sections, Geodesy and Meteorology, to which was added a third, Seismology, in the Royal Society proposals. However, as the result of preliminary, informal meetings at Brussels of the various national delegations, discussion soon developed practical unanimity in the proposals to have each main branch of geophysics represented by an independent section. The resolutions passed by section (*c*) (Meteorology) and (*d*) (Terrestrial Magnetism and Electricity) are good illustrations of the provisions taken also as to cross-relationships

between sections of a union or between different unions.

As far as the future advancement of the particular subjects of Terrestrial Magnetism and Terrestrial Electricity are concerned, it is believed that a step of fundamental importance was taken at Brussels by the assignment of these subjects to a section by itself rather than relegating or subordinating them to some other branch of geophysics with which they might have but a very remote, or even but a purely administrative connection.

Besides receptions tendered by the burgomaster (Adolf Max), the Minister of Education, the Minister of Foreign Affairs, opportunity was afforded for a visit and reception on July 26 at the Uccle Royal Observatories, to whose director, Monsieur G. Lecointe, the signal success of the local arrangements is to be largely ascribed.

Let us hope that the powerful stimulus given geophysical research by the International Research Council will bear the desired fruit and bring about in each country adequate recognition of the needs for the advancement of our knowledge of the physics of the earth!

LOUIS A. BAUER

A MEDICAL SCHOOL, IN THE WAR AND AFTER

LADIES and gentlemen of the classes entering the Cornell Medical College, on behalf of the President, the Acting Dean and the Faculty, I bid you welcome! A year ago the college opened under the shadow of the world war and saddened also by the death of our great dean, William Mecklenburg Polk. Today the college reopens with its ranks filled, with new men added to its staff, and with important departments remodeled on modern lines. Dr. Polk's policy of reorganizing one department after another upon sound scientific principles has been continued since his death.

The war brought to every one the opportunity for public service and the lesson will not be lost. The participation of our college in the war is a cause for quiet satisfaction, and perhaps we may pause for a moment to glance at some of the activities of the institution which has been or is to be your intellectual home. A member of our faculty gave up his practise and went to Washington to assume control of important matters there. On speaking to him of his unselfishness, he replied that his lot was not worthy of sympathy when contrasted with the sacrifice of the many young second lieutenants in the medical service, who had their wives and babies at home to be supported by the meager salary paid by the government. This generous sentiment was illustrative of the spirit that spent itself freely for the welfare of the country.

In 1914 Dr. Stimson, a veteran of our Civil War, went from this college into the front trenches with the Belgians and showed them by candlelight antiseptic methods for the treatment of wounds. He returned there again in 1916 and was planning a third trip before he died in 1917.

One of our professors took the New York Hospital unit to France. Another was chief officer in charge of all the pathological laboratories in France. We visualize such men as healing the wounds of those hurt in battle or seeking out new methods of cure in the laboratories behind the lines.

One of the women graduates of this college went abroad as secretary to the head of the Bellevue Hospital unit. When later the chief of that hospital went to the front he left her in charge of the base hospital, the younger men remaining there willingly recognizing her superiority.

Another of our professors was at first chosen to standardize surgical dressings for the American Red Cross. He also trained 135 army surgeons in the surgery of war wounds. This course aroused their enthusiasm both when it was given and later in retrospect abroad, and it brought the comment from the Surgeon-General's Office that it was the best constructed and most comprehensive course given in the country. This

[1] An address of welcome to the students of the Cornell University Medical College, September 29, 1919.

master surgeon finally won his way to the front in France and, although suffering from the results of a grievous fall which brought great pain at every foot-step, he trudged for miles with our advancing armies. This portrays the spirit of courage and sacrifice which should be a fundamental principle in the practise of your profession.

To those who remained at home the mental hardship of so doing was often very great. One of our professors, when asked to enter the service, was bluntly told by Dean Polk, "If you wish to close this school you can accept this offer." So the man stayed at home and nearly lost his life later in gas experiments for the government.

The war brought its special scientific problems. In this school 429 men were trained in roentgenology, and the first portable x-ray apparatus for use in the field was here constructed.

Through a special knowledge acquired in Bellevue Hospital, another professor so perfected the ventilation system in the submarine that one of our United States boats remained submerged for four days, a world record.

From this school went one who had the scientific supervision over the nutrition of the United States Army. Another distributed a million dollars' worth of food among the Serbians and recently left that country with its fields 90 per cent. planted and its people blessing the American officers for their kindly generosity.

Some of our students entered the regular fighting forces, one leaving the college during his second year in medicine and returning as a major. We welcome those men back to their work with us.

Many other services, heroic and intellectual, were rendered by and through this institution during the great crisis. I have mentioned only a few instances which have come to me. It has been said that no man should be vain of personal accomplishment. Davenport says that if an individual has been given great powers of heart and mind which have been properly developed by education, his intelligent reaction to circumstances is a question of innate mental endowment and, therefore, not a matter for personal conceit. It is permissible, however, to say that you, who are now placed in an environment suggestive of moral and mental capacity, may profitably develop your own capacities each according to his individual endowment.

I have briefly sketched the war activities of some of your teachers. They are in this work of teaching, not for financial reward, but in spite of the lack of it. Professors' salaries have not risen during the war but the professors have not gone on strike.

In Ludwig's physiological laboratory in Leipzig there was an old servant named Salvenmoser who had helped the professor for thirty-five years. When Salvenmoser wished his pay raised be became ill and retired to his quarters in the upper part of the physiological laboratory. During this time the celebrated Professor Ludwig could perform none of his celebrated experiments, and as much as a week might pass before the pay was raised; then Salvenmoser recovered from his illness and the experiments were resumed. In thinking over this little story it seems to me to have been prophetic of the workers of the present day, for many of them have been converted into Salvenmosers—willing to thwart the great experiments of world endeavor by feigning illness. But university professors, however underpaid and hard pressed, have not gone on strike, but stand prepared to serve you for the common good.

I do not know how many of you have read an opening paragraph which has for several years been in the catalogue of the Cornell University Medical School:

> The objects of this school are:
> 1. To develop physicians of the best type and
> 2. To conduct researches into the cause and cure of disease.

As a matter of fact, these two objects are not separable, for in order to produce a modern physician of the best type he must be educated in the atmosphere of developing knowledge which we call research. A cynic of another generation has remarked that the ancients tried to make medicine a science

and failed, while the moderns tried to make it a trade and succeeded. But now the modern trend is in the direction of a true science of medicine.

As you doubtless know, the department of medicine has been reorganized under the wise direction of Dr. Conner. It is our great pleasure to hail the return to Cornell and to the New York Hospital of a man of the exceptional ability of Dr. Foster who for several years has been professor of medicine at the University of Michigan. At Bellevue Hospital the reorganization of the medical clinic by Dr. Conner has placed it in a position to become one of the most powerful influences for medical progress in the country. A full-time staff, Drs. Du Bois, Peters, Barr, Alexander (and McCann will join them), all of whom have been recently discharged from the military or naval services of this country, are giving their entire time for the purpose of instructing students and for carrying on researches into the cause and cure of disease. Three of these men are graduates of the P. and S., two of our own college. Some of the men are supported from the funds of the Russell Sage Institute of Pathology, given by Mrs. Sage for the benefit of the sick poor, and others are supported by friends of the college.

This undertaking followed several years after the introduction of full-time men on the surgical division under Dr. Hartwell. We may all rejoice at the rich opportunities for learning which are offered both in medicine and surgery in Bellevue Hospital.

Another very notable increase in the potential power of the school as a teaching institution has been attained during the summer through the appointment of Dr. Schloss as professor of pediatrics. The true guiding principle of every successful institution has been followed, the appointment of the best man available in the country to fill the place. The highest opportunities for work in pediatrics now lie open to the students of this school and under the best of direction.

An old Swiss physician, Sondereggers, once wrote a letter of advice to a father whose son desired to study medicine, and this letter has so much idealism in it that it seems permissible to read it to you.

> There is nothing greater or more beautiful in the world than man. He is the mightiest and most elevated example of thought and education. His existence, his struggle, his suffering, are all in the highest degree wonderful and stimulating. Thou must bring clear eyes and fine ears, a great talent for observation, patience and again patience for endless study, a clear critical mind which grows stronger in time of necessity, and yet a warm, susceptible heart which understands and sympathizes with every sorrow; religion and moral earnestness which have dominion over lust, money and honor; also a becoming exterior, a polished demeanor, health of body and spirit. All these thou must possess or thou wilt be a bad or an unhappy physician. Thou must carry great knowledge even like to a camel's burden, and also preserve the freshness of the poets. Thou must overcome all arts of charlatanry and in so doing remain an honorable man. Medicine must come first and be thy religion and politics, thy joy and thy sorrow. Therefore I would never advise anyone to be a physician. If he still wishes to be one, warn him again and severely; if he wishes it notwithstanding; then give him thy blessing in so far as he is worthy of it; he will need it.

We will be glad to have all students entering this college feel that they are welcome guests to its halls, guests who come as men and women earnestly desirous of enjoying such intellectual opportunities as are here generously offered. I would ask you to show your appreciation of the gifts which private endowment makes possible, in that you should treat the building and its contents with that scrupulous care and reverence which you would naturally bestow upon the personal property of a generous benefactor who was also a great friend. If you accept what there is here in good spirit, and if the external life of the country permits an orderly community life within these walls, you will find opportunities for golden days in the time to come.

GRAHAM LUSK

SCIENTIFIC EVENTS

COOPERATIVE CONSERVATION OF THE INDIANA-LAKE MICHIGAN SAND DUNES

FOR some time a quiet agitation for the setting aside of this unique region abounding

in rare and valuable flora and fauna specimens has been prevalent in scientific circles. The reservation of this region was formally advocated in a report of Stephen T. Mather, director of the National Park Service at Washington in 1917. The National Dunes Park Association, of which Mr. William P. Gleason, of Gary, Indiana, is now president, has also taken up the matter and has secured a large membership of adherents who enthusiastically advocate the preservation of this wonderland region.

All of these movements have been largely combated by the residents of Porter county, in which the choicest of the dunes are located because of an undercurrent of various misunderstandings. It has been thought by the Porter county residents, and notably the commercial interests of Valparaiso, the county seat, that through a setting aside of the dunes, bordering its fifteen miles of lake front, for a park, would deprive the county of its industrial development which many have held to be paramount to the preservation of those "useless sand hills." The Valparaiso Chamber of Commerce standing primarily for the industrial and commercial development of its valuable water front, strongly opposed any movement looking to the securing of the former objective and the loss of the latter.

Recently there has come into being a new spirit of cooperation. Ex-State Senator Bowser, of Chesterton, Porter county, a director of the National Dunes Park Association has laid a proposal before the Valparaiso Chamber of Commerce, that both bodies cooperate in the attainment of the objectives which have hitherto been considered antagonistic. The bond of cooperation has been formed through the appointment of a general committee, a legal committee and a boundary committee by President John Sievers, of the Chamber of Commerce. Of these the boundary committee consisting of W. E. Harris, Herman Pollentske, Edward Morgan, J. G. Johnson, Guy Stinchfield, George Pearce, Frank R. Theroux have reported in favor of a three-mile lake front park dedicated to Porter county, but this committee wisely qualified their report by stating that the final settlement of boundaries could not yet be determined and many related interests and questions would need to be considered before the limits could be fixed.

It is significant that at a later meeting the Valparaiso Chamber of Commerce passed the following resolution which shows that the business men of Porter county appreciate the importance of the dune conservation undertaking.

> The Valparaiso Chamber of Commerce recommend to the National Dunes Park Association that a board of three consulting engineers be appointed before any final steps on ultimate boundary lines are taken. An industrial engineer to be selected by the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society of Civil Engineers; an engineer on town planning by the Society of American Architects; and a scientist by the Agricultural Department and the Smithsonian Institution to plan coordinately for the proper relation of the industrial, esthetic and scientific Dune-Land heritage nature has placed in the lap of Porter County.

THE IOWA POLICY CONCERNING STATE PARKS

The thirty-seventh General Assembly of the State of Iowa authorized the creation of state parks out of funds from the fees obtained from hunters license fees. It provided that $50,000 be taken out of this fund and on the recommendation of the fish and game warden and the Iowa State Board of Conservation to the executive council state parks could be created and lakes improved. The governor and executive council later (in 1917) appointed L. H. Pammel, of Ames, Joseph Kelso, of Bellevue, and John F. Ford, of Fort Dodge, members of this board, the curator of the historical department being an ex-officio member. The board met and elected Mr. E. R. Harlan secretary and L. H. Pammel chairman.

This board and the fish and game warden recommended the purchase of what is known as the Devil's Backbone Park in northwestern Delaware county. The executive council directed the purchase of some 1,200 acres

along the Msquoketa River, embracing one of the few trout streams left in Iowa, containing also some magnificent old white pine. This park was to have been dedicated on October 1, but owing to unprecedented rains the matter of dedication was postponed. The park was to have been presented by L. H. Pammel on part of the State Board of Conservation and accepted by Governor W. L. Harding. Five-minute talks were also to be given by other members of the board.

A second state park has recently been established in what is known as the horseshoe bend of the Des Moines River near Keosauqua. The board and executive council also authorized the purchase of the largest boulder of the Iowan drift in the Mississippi valley, and three acres of land surrounding the boulder.

The Keosauqua area of 1,123 acres contains a large number of interesting native trees especially oaks and shrubs. Among the birds, some of the rarer species in Iowa are found here, like the drumming pheasant. Bob white is abundant. The board went so far as to get the signatures of all farmers within a mile from the park to preserve this area outside of the park as a wild-life reserve.

The policy of the board will be to keep the lakes and purchase land on the shores for state parks, to establish one or more highways or county parks in many of the counties in the state. The larger parks are to be for the "preservation of places of historic, natural or recreational interest authorizing donations in aid of such purposes and to make an appropriation therefore, provided for aid by municipal corporations and authorizing boards of supervisors to extend county road systems." Many generous gifts have been made. The Brandt sisters of Davenport donated 57 acres in what is known as "Wild Cat Den," containing some rare ferns and interesting from an ecological standpoint. The citizens of Farmington and Van Buren county purchased outright 100 acres containing a lotus (*Nelumbo lutea*) pond of 40 acres.

There have been more than 100 petitions for state parks. Where it is not possible to buy at this time leases are made so that the wild life may be preserved along the Yellow River in Allamakee county and the Ice Cave near Decorah. The thirty-eighth General Assembly appropriated $100,000 annually for the creation of these parks, eliminating the fish and game warden so that the recommendations now are direct to the executive council from the State Board of Conservation.

MATTERS OF SCIENTIFIC INTEREST IN CONGRESS[1]

MR. FESS has reintroduced his bill for a national university, which failed of final action in the Sixty-fifth Congress. The present bill is H. R. 9353: "To create a national university at the seat of the Federal Government." The institution, to be known as the "National University of the United States," is to be governed by a board of trustees, consisting of the U. S. Commissioner of Education and twelve appointed members; the acts of the board are subject to approval by an advisory council, consisting of one representative (usually the president of the State University) from each state. No student is to be admitted unless he shall have obtained the degree of master of science or master of arts from an institution of recognized standing. No academic degrees are to be conferred. An initial appropriation of $500,000 is provided. The bill was referred to the Committee on Education.

A fact of interest to the scientific public is that the "Army reorganization bill" (S. 2715, Mr. Wadsworth; and H. R. 8287, Mr. Kahn) makes no mention of the Chemical Warfare Service. In his letter accompanying the bill, Secretary of War Baker suggests that the Chemical Warfare Service be made a part of the Engineer Corps. The proposal to abolish the Service as a distinct unit, comparable with the Tank Corps, is being vigorously opposed by the Council of the American Chemical Society.

Warnings issued by the Public Health Service in September that a recurrence of the 1918 pandemic of influenza was probable in

[1] From the *Journal* of the Washington Academy of Sciences.

the autumn months of 1919, stirred renewed interest in the various bills and resolutions providing for investigations of that disease, but no final action had been taken at the time of this report, although Mr. Harding's S. J. Res. '76 was reported in the Senate on October 1.

On September 3, Mr. McKellar introduced S. 2920: "To enable the Secretary of Agriculture to carry out investigations of the causes and means of prevention of fires and dust explosions in industrial plants." The bill provides $100,000 for such investigations. Referred to the Committee on Agriculture and Forestry.

A plan for private development under Federal concessions, of the platinum resources of Alaska is contained in H. R. 8988: "To incorporate the United States Platinum Corporation and to aid in the development of the mineral resources of Alaska, and for other purposes," introduced on September 3 by Mr. O'Connell (by request). The proposed Corporation would have a capital stock not to exceed $50,000,000; would be exempt from Federal taxation; would be empowered to receive concessions and leases of government-owned platinum sands in Alaska; would pay a royalty of one eighth of its net products; and would furnish $100,000 for the maintenance of five "U. S. Government Commissioners of Platinum and its Allied Industries," whose duties are not defined in the bill. Referred to the Committee on Public Lands.

No action was taken on the invitation of the French government to send delegates to a meteorological conference in Paris on September 30, and the United States was, therefore, not officially represented.

AMERICAN ORNITHOLOGISTS' UNION

The thirty seventh stated meeting of The American Ornithologists' Union will convene in New York City, from November 11 to 13. The headquarters will be at The Belleclaire, Broadway and 77th Street. Owing to the crowded condition of hotels in New York, members intending to be present are urged to make reservations well in advance. Reservations might also be made at The Pennsylvania, opposite the Pennsylvania Station, 7th Avenue and 33d Street.

The public meetings will be held at the American Museum of Natural History, 77th Street and Central Park, West, from 10 A.M. until 4 P.M. each day. The reading of papers will form a prominent feature of the meetings. All classes of members are earnestly requested to contribute, and to notify the secretary before November 5, as to the titles of their communications, and the length of time required for their presentation, so that a program for each day may be prepared.

As this is the first meeting since the war, interesting reports may be expected from some of the members who served in the military or naval service. In addition to the usual social features there will be opportunities to visit the New York Zoological Park, the Brooklyn Museum, Audubon's home in Audubon Park, and the New York Historical Society, where the original drawings of Audubon's Birds of America are preserved.

Each member is requested to recommend to the secretary the name of at least one new associate for election to the union.

T. S. Palmer,
Secretary

1939 Biltmore St., N.W.,
Washington, D. C.,

SCIENTIFIC NOTES AND NEWS

Dr. Theodore W. Richards, professor of chemistry at Harvard University, and director of the Wolcott Gibbs Memorial Laboratory, has been elected a foreign member of the Royal Society of London.

Provost Edgar F. Smith, of the University of Pennsylvania, received the degree of doctor of laws from Queen's College at Kingston, Ontario, at the convocation of Canadian universities on October 16.

Dr. Frederico Giolitti, formerly professor of metallurgical chemistry and metallography at Turin has been presented with the Bessemer medal of the British Iron and Steel Institute.

Dr. Eric K. Rideal, a graduate of Cambridge University and of the University of

Bonn, more recently captain of the Royal Engineers in the British Army, has been appointed visiting professor of physical chemistry at the University of Illinois for the current year.

PROFESSOR GEORGE C. WHIPPLE, of Harvard University has been appointed director of the division of sanitation in the bureau of hygiene of the International League of Red Cross Societies. The associate director will be Colonel Francis F. Longley, U. S. A., who served as colonel of the 26th Engineers in France.

THE Massachusetts Forestry Association has submitted to the Governor of Massachusetts the names of Herman H. Chapman, of the Yale Forest School, New Haven, Connecticut; E. C. Hirst, state forester of Concord, New Hampshire, and William C. Howard, assistant superintendent of the State Forests, Albany, New York, as candidates to head the Massachusetts Division of Forestry, and also to fill the office of commissioner of conservation.

AMONG the war prizes awarded by the French Academy of Sciences are the three Montyon prizes of £100, given respectively to MM. Louis Martin and Auguste Pettit, of the Pasteur Institute, for a memoir of icterohemorrhagic spirochetosis; MM. Weinberg and Seguin, of the same institute, for a research on gas gangrene; and MM. Rouvillois, G. L. Pédeprade, and A. Basset for their studies on war surgery. A prize of £120 was awarded to M. Paul Ravaut for his researches on paludism, and one of £80 to M. Goris for studies on the localization of alkaloids and glucosides in vegetables and on the preparation of catgut.

DR. W. H. RANKIN, for five years assistant professor of plant pathology in the New York State College of Agriculture at Cornell University, has been appointed officer in charge, Field Laboratory of Plant Pathology, St. Catherines, Ontario, in the Canadian department of agriculture, and has entered upon his duties.

PROFESSOR J. O. ARNOLD, dean of the faculty of metallurgy and professor of metallurgy in the University of Sheffield since 1889, has retired.

DR. ELWOOD MEAD, professor of rural institutions in the University of California and chairman of the California Land Settlement Board, has been appointed a member of the National Bureau of Economic Research.

DR. OLIVER KAMM, assistant professor of organic chemistry in the University of Illinois, has returned to Urbana after an eight months' leave of absence spent in organizing a chemical research laboratory for the American Writing Paper Company, at Holyoke, Mass. Dr. R. E. Rindfuss, of the University of Illinois, has accepted a permanent position with the same company as director of Chemical Research. Dr. Kamm remains connected with the company in an advisory capacity.

MR. PAUL C. STANDLEY, of the Division of Plants, U. S. National Museum, has returned from a collecting trip through Glacier National Park, Montana. Data were secured for a handbook of the plants of the park, to be issued by the National Park Service.

PROFESSORS EDWARD W. BERRY AND JOSEPH T. SINGEWALD, JR., of the Johns Hopkins University, have returned to Baltimore, after spending six months in geological investigations in the South American Cordillera. Over one thousand miles were traversed on mule-back and the Andes were crossed eight times between Huancayo, Peru and Concepcion, Chile. Much valuable material was shipped home. The expedition was made possible by a fund in memory of the late Professor George H. Williams.

PROFESSOR OLAF P. JENKINS has resigned from his position as geologist to the Arizona Bureau of Mines, University of Arizona, at Tucson, to undertake geological work in foreign countries for S. Pearsons & Son, Ltd., of London.

DR. C. BONNE and his wife, Mr. C. Bonne-Wepster, of Surinam (Dutch Guiana), students of South American mosquitoes, are spending two months at the National Museum in the study of the mosquito collection.

Alfred F. Barker, professor of textile industries at the University of Leeds, England, has been visiting the United States.

Nature states that the Scandinavian Association for a Tropical Biological Station has decided to send an expedition this autumn to select a site for a research station to study marine biology. Dr. Th. Mortensen, who is chairman and founder of the association, will lead a small party including probably Dr. Nils Holmgren and a botanist. They will visit Celebes, North Borneo, Amboina, and New Guinea.

Dr. Vito Volterra, professor of mathematical physics in the University of Rome, and a member of the Italian Senate, delivered six lectures on the Hitchcock foundation at the University of California, between October 13 and October 21. The subject of the first four lectures was "The Propagation of electricity in a magnetic field," and that of the last two was "Derivate functional equations." During his stay in California he visited the Yosemite Valley and was a guest of Director Campbell at the Lick Observatory and of Director Hale, at the Mount Wilson Observatory. After visiting the Grand Canyon of the Colorado he will go to Houston, Texas, where he will give some lectures at Rice Institute. From there he will go to the Atlantic coast, where he will visit a number of universities.

A series of fortnightly lectures on industrial problems are being delivered at the Guildhall, London, under the auspices of the Industrial League and Council. The speakers will include Mr. E. J. P. Benn, Professor Ripper, Dr. Russell Wells, Sir Auckland Geddes, Sir George Paish and Lord Emmott.

J. W. H. Trail, F.R.S., who for fifty-two years held the chair of botany at the University of Aberdeen to which he was appointed at the age of twenty-six, died on September 18.

It is stated in the *Journal* of the Washington Academy of Sciences that the proposed American Meteorological Society, formal organization of which is suggested for action in connection with the next meeting of the American Association for the Advancement of Science, is expected to have a large Washington membership, drawn from the staff of the Weather Bureau and from among the meteorologists of the Army and Navy. It is suggested that the *Monthly Weather Review* be made the medium for publishing meteorological and climatological articles, while a monthly leaflet published by the society would contain news, announcements, notes and queries.

The following resolution was adopted by the technical Association of the Pulp and Paper Industry at the meeting held in Chicago, for September 24 to 27.

Whereas, due to the decay of pulpwood and woodpulp the paper industry is suffering an annual loss of $5,000,000, and

Whereas, in order to reduce this loss to a minimum a scientific investigation of the cause and possible control of such infection is essential, and

Whereas, The Forest Products Laboratory, U. S. Department of Agriculture, Madison, Wis., is in an exceptional position to undertake this special investigation, Therefore,

Be it resolved, that this association use every means within its power to secure a specific appropriation of $50,000 for this special investigation to be conducted by the Forest Products Laboratory, United States Department of Agriculture, Madison, Wis.

Through the action of the congressional Public Buildings Commission, of which Senator Smoot is chairman, the U. S. Geological Survey has been compelled to give up to the Internal Revenue Bureau nearly half of its office space in the Interior Department Building. *Economic Geology* says: "This by forcing as many as three geologists to work in a single small room with no adequate space for the study of maps and collections is a serious blow at the efficiency of the organization. The action is an example of the failure of Congress to understand the nature of scientific work and to realize that a geologist's room is essentially a laboratory within which it should be possible to retain in accessible condition, collections of minerals, rocks and ores representing field work that in some investigations may extend over a period of several years."

UNIVERSITY AND EDUCATIONAL NEWS

THE late Sir Samuel McCaughey has bequeathed $2,000,000 to the University of Sydney and $1,250,000 to the University of Brisbane.

DR. G. MCPHAIL SMITH, formerly of the University of Illinois, has been appointed head of the inorganic division of chemistry at the University of Washington, Seattle.

DR. ROBERT GESELL, of the department of physiology in the Washington University Medical School, St. Louis, has been appointed professor of physiology in the University of California.

DR. H. I. COLE, who served overseas as captain in the U. S. Chemical Warfare Service, and was lately associated with the Arthur D. Little Corporation as chemical microscopist, has accepted the appointment of professor of chemistry at the University of Oregon during the absence of Professor Stafford who will be engaged during the coming year in private research in the east.

DR. HIRAM BYRD, formerly scientific secretary of the State Board of Health, of Florida, has accepted the directorship of the Department of Hygiene in the University and the Interdepartmental Board of Social Hygiene.

PROFESSOR BOHUMIL SHIMEK, head of the department of botany in the State University of Iowa, requested last spring that he be relieved of administrative work and much of his teaching in order that he might concentrate on his research. Dr. Robert B. Wylie, professor of morphological botany, was then made head of the department. These changes have been effective for the present academic year.

THE following appointments have been made on the Faculty of the Marquette School of Medicine: Fred T. Rogers, Ph.D., formerly assistant professor in the department of physiology, University of Chicago, professor and director of the department of physiology; Otto F. Kampmeyer, Ph.D., formerly connected with the University of Illinois, associate professor of anatomy; Albert J. Bruecken, M.D., formerly pathologist and bacteriologist in Mercy Hospital, Pittsburgh, and demonstrator of pathology at the University of Pittsburgh, junior professor of bacteriology; S. C. Henn, Jr., M.S., formerly fellow in the department of physiology, University of Chicago, instructor of physiology, and John Tilleman, A.B., assistant, in the department of pathology.

B. M. JONES, Emmanuel College, has been elected to the Francis Mond professorship of Aeronautical Engineering at the University of Cambridge, founded by Mr. Emile Mond in memory of his son, who was killed in the war. Mr. Jones obtained honors in the mechanical sciences Tripos of 1909, and from 1919 to 1912 he was employed on aeronautical research at the National Physical Laboratory. During the war he became assistant controller of experiment and research in the Armament Experimental Station with the rank of lieutenant-colonel.

DISCUSSION AND CORRESPONDENCE

UNIFORMITY IN SYMBOLS

THE hapless student beginning work in aerography and aeronautical engineering, today, may well sympathize with the writer in SCIENCE,[1] who two years ago expressed the wish that some uniform set of symbols might be used. He spoke as a sorely tired reader of recent contributions in meteorology, astronomy and geodesy. His closing appeal was *"Don't let details smother uniformity. Make a start."*

Up to the present time the number of those starting is not impressive, and although we do not want to rush in where angels (?) fear to tread, we venture now to offer a tentative set of symbols for the guidance of those who contemplate work in aerography and allied subjects.

That the perplexity is a real one will appear when we mention that in a recent memoir on dynamic meteorology the letter γ has three different meanings, viz: ratio of specific heats, gravity and temperature gradient. Some

[1] Dr. Otto Klotz, SCIENCE, Vol. XLVI., No. 1189, p. 360, October 12, 1917.

writers, especially the English, use this same symbol for the gradient wind. So too with λ. In astronomy it indicates longitude, in physics, wave-length; but some recent writers on meteorology and aeronautics use it for latitude.

Again, in tracing the development of a formula, one will meet for atmospheric pressure, p, b, P, B, h and H used indiscriminately; v for volume, velocity or radiation; s may be space or seconds; t time or temperature; and R may be a gas constant or the radius of the earth.

We therefore venture to make the start by proposing the following which it is thought conform to the best and latest usage.

ϕ = latitude.
λ = longitude.
π = 3.1416.
e = base nat. logs. 2.718.
ω = angular velocity of earth's rotation. $= 2\pi/86{,}164$ sec. $= .00007292$.
κ = ratio of specific heats, constant pressure to constant volume.
$\kappa_1 = k$ for air $= .2375/.1683 = 1.41$.
k for water vapor $= .4734/.3631 = 1.30$.
C_{p_A} = specific heat dry air at constant pressure, in heat units .2375.
C_{v_A} = specific heat dry air at present volume, in heat units .1683.
C_p = specific heat dry air at constant pressure in grav. force 9935787.
C_v = specific heat dry air at constant volume in grav. force 7065453.
ρ = density.
ρ_1 = density of water at standard conditions $= 1$.
ρ_2 = density of dry air at pressure 1,000 kilobars and temperature, 1,000 kilograd 1,276 gms./cu. m.
ρ_3 = density of water vapor pressure 1,000 kilograd = 5 gms./cu. m.
g_o = acceleration due to gravity at 45 latitude and sea-level, 980.615 cm./sec^2.
g_v = gravity potential $= g_o/1{,}000z$.
$\frac{dg_o}{z}$ = normal gravity decrease with altitude = .0003086 dynes/meter.
b = bar or unit of pressure expressed in force $= 1$ dyne/cm.^{2}.
kb = kilobar or 1,000 bars, the pressure unit commonly used.
mb = millibar or 1/1,000 bar.
mgb = megabar or one million bars. This pressure is an absolute atmosphere of .987 of the old sea-level atmosphere. It is the pressure given by 750.1 mm. of mercury (29.53 inches).
One megabar atmosphere acting through one cubic centimeter does one megerg of work.
$1/A$ = mechanical equivalent of heat = 42683.
g_o/A = gravity work of heat = 41,851,000 ergs.
A = heat equivalent of work = .000023.
A/g_o = heat equivalent of gravity work = .000000023.
v = volume; m_s = mass; l = length; $vel.$ = velocity; z = vertical distance; p = pressure.
r = radius; s = second; m = meter; m/s = meters per second.
R = gas constant, which is not a constant in the atmosphere, for there is circulation and gain or loss of heat. The student should question all equations in atmospherics in which it is assumed that the gas coefficient is a constant.
R = 2,870,000 if pressure is in bars.
T_F = temperature on the Fahrenheit scale. Freezing 32°; boiling 212°.
T_C = temperature on the Centigrade scale. Freezing 0°; boiling 100°.
T_A = temperature on the Absolute Centigrade. Freezing 273°; boiling 373°.
T_K = temperature on the Kilograd. Freezing 1,000°; boiling 1,366°.
Ratio of scales: 1 degree F. = 2.04 K.
1 degree C. = 3.66 K.
1 degree K. = 0.491 F.
1 degree K. = 0.273 C.
σ = radiation constant $= 5.7 \times 10^{-12}$.
N = Avogadro constant $= 6.06 \times 10^{23}$.
n_o = number of gas molecules per cu. cm. at 1,000 kbs. pressure and 1,000K. temperature $= 2.705 \times 10^{19}$.
m_h = mass of hydrogen atom $= 1.662 \times 10^{-24}$.
e_l = electron $= 4.774 \times 10^{-10}$.
Q = heat energy; W = external work; U = inner energy.
r_{eq} = earth's radius at equator = 6,378,388 meters (3,963 miles).

Alexander McAdie,
George P. Payne

Blue Hill Observatory,
October 18, 1919

OROGENICS OF THE GREAT BASIN

WHEN, about forty years ago, the members of the Fortieth Parallel Survey leisurely traversed the mile-high Great Basin between the lofty Rockies and the Sierra Nevada, their impressions on the configuration of the mountain ranges were that there was chiefly folding of the Appalachian type wherein the synclines were deeply and almost completely filled with illy transported rock-waste from the neighboring highlands.

A decade later, corps of other governmental surveys, passing through this part of the country, put an entirely different interpretation on the origin of the rugged desert ranges. Novel as well as brilliant was the conception that these mountains were recently tilted fault-blocks of gigantic size. This fancy led to another brilliant idea—the hypothesis of isostatic compensation, whereby there is ready response to the transference of eroded rock materials from one point to another, loading areas sinking and unloading areas rising.

Curiously enough when the isostatic hypothesis came to be critically tested in the field no faults bounding the orographic blocks were discoverable. More than a third of a century passed since the idea was first promulgated and yet no one appeared to find impeachable evidences of the alleged crustal ruptures. A governmental expedition, especially fitted out to solve the problem and headed by the author of the hypothesis himself, failed to establish the claim or to publish the desired data. Many of the so-called fault-scarps which were described as marking the basin ranges proved not to be fault phenomena at all, but merely characteristic features of normal eolic erosion at the level of maximum activity. Other investigators searching especially for the assumed faults found not major lines of this character bounding the present mountains but instead discovered dislocation phenomena in the most unexpected situations —far out on the smooth intermontane plains. There was manifestly no genetic relationships existing between mountain profile and geologic structure. On the whole the proposed hypothesis of Basin Range structure proved to be singularly unsupported by observation.

In the meanwhile testimony of another kind abundantly accumulated bearing upon the problem. When the presence of faulting was all but completely discredited, it was shown that although extensive rupturing actually occurred in the region it was mainly relatively ancient. It long antedated the time when the present mountains took form.

There is, however, a third possible explanation of the faulting phenomena displayed in the Great Basin. The major faulting of the region may not be of the normal gravity type as is so commonly supposed. It may be mainly of overthrust character. In support of this suggestion, as a general proposition, there are a number of considerations besides the almost conclusive theoretical one. A remarkable circumstance is that some of these thrust-planes in the desert ranges are often mistaken for lines of unconformities. This may be the real reason why so few normal faults are found bounding the mountain blocks. The overpowering influence of the normal fault idea has much to do with the general misinterpretation of Basin Range orogeny.

Concerning the tectonic genesis of the desert ranges we shall now probably have to give up our brilliant conceptions of mountain blocks floating on the liquid interior of the earth much after the fashion of ice-cakes in a river at time of spring break-up. What the substitute shall be may not yet be perfectly clear. Mountains of circumdenudation through the differential activity of eolic erosion under the stimulus of the aridity and over a region previously effected widely by overthrust movements seems more nearly in accordance with the larger aspects of the conditions presented. At least the extent of the overthrust activity is worthy of the most careful consideration and severest test in the field.

CHARLES KEYES

DISTRIBUTION OF THE FRESH-WATER MEDUSA, CRASPEDACUSTA, IN THE UNITED STATES

IN SCIENCE, November 8, 1907, the writer published a brief account of the appearance

of this interesting medusa in this country, and in the *Biological Bulletin* of April, 1908, described in some details the history of the case, and evidence of its identity with *Limnocodium sowerbii* of Europe. These were the first accounts of this species in the United States, and its occurrence at that time in the aquarium of a green-house in Washington, D. C., used by its owners for propagating exotic tropical plants, suggested its possible introduction by means of such plants. But the assurance of the proprietor that only the *seeds* of such plants were imported threw serious doubt upon such an inference.

In Science, December 15, 1916, Professor H. Garman reported a most interesting occurrence of this medusa in Benson creek near Frankfort, Kentucky, and later the present writer received from Professor Garman specimens which were identified as the same as those formerly described from the Washington aquaria. Here in this fresh-water stream, a small tributary of the Kentucky river, far removed from any possible source of artificial introduction, the occurrence of "millions" of these medusæ, at once utterly discredited the earlier asumption of distribution by artificial means from tropical sources of its assumed habitat.

On October 4, 1919, I received from Professor F. Payne of Indiana, a letter announcing the finding of these medusæ in a lake in northern Indiana, and on the following day an official communication from the Bureau of Fisheries announcing its receipt from "Boss Lake" near Elkhart, Indiana, of medusæ presumed to be the same as those formerly described from Washington, D. C., and later from Kentucky, as cited in the above paragraph, and this was easily verified on the receipt of excellent specimens preserved in formalin. These were accompanied by copies of letters from Mr. J. C. Boss, owner of the small lake mentioned above. This lake was constructed by Mr. Boss, and the following abstract from his letter to the Commissioner of Fisheries will be interesting.

Boss Lake resulted from the overflow caused by the building of a large dam on the St. Joseph River. Our family owned and operated a brick yard at a point on said stream the backwater of which flooded so large a portion of the clay bank that it ruined it for commercial purposes. A large dyke was built between the clay pit and the river, reinforced by puddled clay to make it as nearly as possible water tight so we might raise the water to a height of about seven or eight feet above flood tide of the river; this purpose was accomplished effectively and the lake so stands to-day. The lake contains about four acres, is fed by surface spring water and an artesian flowing well, the level remaining constant.

This lake has been stocked with Black Bass supplied by the Bureau of Fisheries, and Mr. Boss states "there have never been any plants from other lakes introduced or planted in this, especially not of exotic species," though it abounds in native aquatic grasses, he states.

A most interesting feature comes to light in the data furnished by Mr. Boss, namely, that the medusæ were first observed one year ago, then very few in number. This year about August first they again appeared and in greater numbers, and during "ten days we have seen millions, they come to the surface on warm sunshine days." That is, not only have these formerly supposed tropical medusæ established themselves in northern waters, and persisted over winter, but have greatly multiplied during the second year, hence breed freely under these conditions. Those found in the Kentucky creek apparently disappeared very suddenly, as did those in the Washington aquaria as reported in my former papers, on the approach of cooler weather; and in neither of these localities have they reappeared, so far as known, Professor Garman stating his purpose to closely follow up the matter the following year having made no further report.

These several occurrences of this medusa in the fresh waters of this country clearly proves that it has become an indigenous faunal factor and clearly able to perpetuate itself, and further that it has not at any time been introduced through artificial means from remote regions. It still remains prob-

lematic as to the precise processes of its distribution, propagation and life history. But among the present material numerous female specimens occur, a feature not previously described. Hydroid phases of the organism have been but vaguely suggested.[1]

C. W. HARGITT

SYRACUSE UNIVERSITY,
October 11, 1919

SCIENTIFIC BOOKS

Observations on Living Lamellibranchs of New England. By EDWARD S. MORSE. Proc. Boston Soc. Nat. Hist., Vol. 35, no. 5, July, 1919, p. 139–196, Figs. 1–48.

The state of New York once published an imposing quarto report on its mollusca of which the only feature remaining in the memory of the present reviewer (except the minus value of that part supposed to cover the nudibranchs) is an exquisite hand-colored engraving, nearly life size, of a common "horse-mussel" shell showing every accidental scratch, every adhering bit of alga or barnacle, every growth line, each abraded spot, a piece of dried mud and a chipped place on the margin, with more than photographic minute accuracy. It was impressive. It was costly. It was uninspired, It was valueless.

Professor Morse's little paper is in every respect the opposite. Its 57 octavo pages and 48 rough outline text figures probably cost all together a small fraction of what that gorgeous portrait of a mussel shell alone cost the state of New York. But those pages add more to our knowledge of American molluscs than the entire imposing quarto and each simple drawing is a work of true art. Of some it is not too much to say that, while drawn for the sake of the soft parts alone, and practically confined to outline, they constitute the most characteristic extant representations of the shells. It must have been his years of intensive study of Japanese pottery that gave Professor Morse full appreciation of the value of subtly correct outlines and the importance of omitting non-essentials, for although his work shows he was already an artist when he first published figures of molluscs fifty-five years ago, and his drawings of living brachiopods have been famous for their vital accuracy, it seems to have been reserved for his return to biology after his Japanese interlude, and for the riper age of eighty-one years, for him to attain the acme of the art of telling with his pencil the most, and the most truly, about an animal in the most simple way.

Although American malacology has, if anything rather more fully than European, recognized theoretically that the "soft parts" are, after all, the animal that is being studied, and the shell (except as a paleontological marker) of little value except for what it can tell us about that animal, yet in practise it has fallen woefully behind Europe in study of the animal as distinguished from its shell. This is particularly true of the marine Pelecypods. Pilsbry and others, successors of Binney, have elucidated our land snails, while Baker and Walker have thrown a flood of light on our fresh-water Gasteropoda, and Ortman, Sterki and others under the stimulus of Simpson's work on the Naiades have dealt fruitfully with the fresh water Pelecypoda. The marine Gasteropoda have had more scattered attention but on the whole their bolder habits and more varied and striking anatomy have attracted a considerable mass of observation, while the shy and rather monotonous animals of the marine Pelecypoda have been neglected. There have been a few intensive studies of single forms by Drew and others; but Dall and Verrill, whose work on this group outbulks many times over that of all others combined, have handled chiefly fossil or deep-sea or preserved material or else "just shells" as usually sent in by the amateur collector. Thus a large proportion of the present paper consists of novel observations while the graphic records of those observations are almost wholly novel.

One could wish that Professor Morse had

[1] Since the foregoing notes were written I have received later statements from Dr. Payne that he has made several trips to the lake and has undertaken fuller investigations than are at present possible to me, and will doubtless issue them in due time.

gone on to make comparison with allied European forms as beautifully figured in Meyer and Möbius' "Fauna der Kielerbucht" and elsewhere, but he has stopped with a bare record of facts from which he leaves others to extract the conclusions.

The feature of the paper which will excite the most comment, though the least worthy of it, is the savage onslaught on present-day nomenclatorial methods, backed up by the deliberate retention of the nomenclature of fifty years ago as seen in the classic "Binney's Gould." Since the author expressly states that he follows this particular work consistently, and since that work is so important that its names are included in the synonymy of almost every modern list, no actual doubts can arise from this course. It will be easier for any student hereafter to ascertain the correct name of any of Morse's forms that it would have been if, for instance, he had used the 1915 nomenclature when he ought to have followed the fashion of 1919. Particularly is this true as to the generic names, but it does seem a pity not to use a certain discrimination as to specific names. For instance, to call Gould's "*Modiolaria discors*" a "*Modiolaria*" can cause no doubt or confusion even though "*Modiolaria*" has suffered a recent dislocation very likely temporary. But to call it "*discors*" when it is really *substriata* Gray and widely distinct from the strictly European *discors* for which Gould mistook it, is to perpetuate a demonstrated error of fact.

As for the slashing attack on modern nomenclatorial vagaries it probably will have small effect; first because it covers a field already well debated and second because the criticism is almost entirely destructive. It may fairly be said that Professor Morse is as much at fault for failing to recognize that the old system had become nearly intolerable as the perpetrators of the new system are for failing to recognize that it is equally nearly intolerable if not more so. It may serve a useful purpose if it helps awaken the conscientious and learned but timid and unimaginative men who have made a mess of modern nomenclature to the fact that while they are repelling young students and driving them to other fields on the one hand, they are disgusting and irritating old masters to the point of open rebellion on the other.

The paper contains altogether too many typographical errors; and a few slips on the author's part—as where he says (p. 167) that besides *Glycimeris siliqua* the only other form he is acquainted with having the anal siphon larger than the branchial is *Anatina papyracea* and then (p. 190) both figures and describes *Ceronia arctata* as showing the same condition.

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Boston, Mass.

SPECIAL ARTICLES

RESEMBLANCES BETWEEN THE PROPERTIES OF SURFACE-FILMS IN PASSIVE METALS AND IN LIVING PROTOPLASM, II.

ACTION OF SALT SOLUTIONS AND ORGANIC COMPOUNDS. ANTAGONISMS

Pure solutions of the majority of neutral salts activate passive iron, at a rate which varies with the nature and concentration of the salt. Both classes of ions are concerned in the effect.

In general the stability of the surface-film in any solution—and hence the preservation of the passive state—is intimately dependent upon the oxidizing properties of the dissolved substances. Many solutions whose oxidizing power is insufficient to impart passivity to active iron retard or prevent the spontaneous return of the passive metal to the active state; this is true, *e. g.*, of weak solutions of nitric acid or bichromate ($m/10$ to $m/50$). Obviously when a solution imparts passivity it also preserves it, but the reverse is not always true. In media with no definite oxidizing action, *e. g.*, distilled water, passivity soon disappears; continued oxidation seems necessary for its preservation.

The following experiments have aimed at a more precise determination of the conditions under which the passive state is preserved or destroyed in different solutions; evidently such conditions correspond to the conditions of stability of the surface-film. Iron wires

were first passivated by exposure to 1.42 HNO_3; they were then washed thoroughly in distilled water[1] and transferred to the solution under examination; after the lapse of a measured time of exposure they were again washed in water and placed in dilute HNO_3 (*s. g.*, 1.20). If activation has occurred in the solution, darkening of the surface and effervescence begin instantly; while if the exposure has been insufficient, no effect is seen and the wire remains passive.

In most solutions of salts and other electrolytes a spontaneous return of activity occurs after a greater or less interval, the length of which depends upon the nature and concentration of the compound. In the total effect produced by the solution both classes of ions are concerned; and no relation of activating or passivating influence to the sign of ionic charge is apparent. All ions of strong oxidizing properties tend to stabilize the passive condition (*e. g.*, Cr_2O_7, MnO_4, Ag, Au, Pt), while others (especially Cl, Br, I) have a strong activating influence, referable possibly to a colloidal (aggregative or dispersive) action upon the film. In pure solutions of alkali and alkali earth salts (except those with strongly oxidizing anions like MnO_4 and Cr_2O_7) passivity is always soon destroyed, within periods ranging from a few seconds or minutes to half an hour or sometimes longer. The presence of oxygen in the anion (especially if in a terminal position) appears always to retard the process of activation. In solutions of nitrates, chlorates, phosphates, sulphates, carbonates, tartrates, citrates, acetates ($m/2$ to $m/20$) passivity remains for usually several minutes; activation is more rapid with hydrates; while halides in much lower concentration activate within a few seconds.

Different specimens of iron vary considerably in the time required for activation in a given solution, apparently because of variations in the finer structure of the metal. All of the following observations were made with the same kind of wire (no. 20 piano wire, *ca.* 1 mm. in diameter); the metal of this wire is, however, not homogeneous; in particular it was always found that freshly cut and slightly used wires were decidedly more sensitive to activation than wires which had been used for some time and in which the outer layer had been dissolved away. Apparently the surface-layer of a drawn wire is less homogeneous than the core, and hence forms a less uniform and stable passivating surface-film. To obviate this source of irregularity, in the following experiments wires were used which had been reduced by the acid to two thirds or less of the original diameter. Such wires when passivated exhibit a relatively uniform behavior in salt solutions, although in the more slowly activating solutions the exact time required for activation still shows considerable variation. This variability has probably the same basis as the variability in the rusting properties of different specimens of iron. In each trial of a particular solution in any series of experiments several independent determinations with different wires are therefore necessary; as a rule these show good agreement, with occasional well-marked variations, due presumably to accidental variations of structure or composition in the exposed surface of the metal.

Halides.—Solutions of metallic chlorides, including those of noble metals (Hg, Au, Pt), activate passive iron with great rapidity. The following series of experiments with four chlorides are typical and illustrate the dependence of time of activation upon concentration; they also show the relative unimportance of the cation in such solutions. In each solution seven trials with seven separate wires were made with each length of exposure; time was marked by a metronome; the wires were transferred by glass hooks from the distilled water to the tubes containing the solutions. The time given is the usual minimal exposure required to render the passive wire reactive to dilute HNO_3; with briefer exposures the wires remain passive.

[1] Passive wires retain their passivity in distilled water for a considerable period—ranging in various experiments from 15 to 23 minutes at room temperature—but not indefinitely, a fact again indicating that the passive state is preserved only when there is the possibility of continued rapid oxidation.

Conc.	NaCl	KCl	$CaCl_2$	HCl
$m/50$	*ca.* 1 sec.	*ca.* 1 sec.	*ca.* 1 sec.	*ca.* 1 sec.
$m/100$	1 to 2 "	1 to 2 "	*ca.* 1 "	1 to 2 "
$m/200$	3 "	*ca.* 3 "		
$m/400$	4 to 5 "	*ca.* 5 "	2 "	4 to 5 "
$m/800$	*ca.* 6 "	10 "	4 to 5 "	
$m/1{,}000$				10 to 12 "
$m/1{,}200$	*ca.* 10 "		*ca.* 8 "	
$m/1{,}600$		16 "		

These series were carried out at different times and with different wires, and the results are not strictly comparable. In general, however, the rate of the activating process, in the case of each salt, is approximately proportional to the concentration. A progressive alteration of the surface-film, at a rate determined by the concentration of Cl-ions, appears to underlie the effect. With the above chlorides the nature of the cation seems indifferent; but with the chlorides of noble metals a retarding influence of the cation is apparent; thus $m/4$ $HgCl_2$ required 2 to 3 seconds for activation and $m/8$ $HgCl_2$ 3 to 4 seconds. A comparison of the three chief halides showed a decreasing velocity of activation in the order, Cl, Br, I; in $m/50$ solution the minimal times for activation were: NaCl, 1 to 2 seconds; NaBr, 3 to 4 seconds; NaI, 12 to 14 seconds.

Other Salts.—Activation occurs much more gradually in solutions of other salts. The following results are typical for the minimal activating exposures in $m/2$ solutions of sodium salts:

NaOH	10 to 30 seconds
Na_2CO_3	2 to 4 minutes
Na_2SO_4	1 to 10 minutes
Na_2HPO_4	3 to 5 minutes
Na-acetate	80 sec. to 4 min.
Na-tartrate	2 to 4 minutes
Na-citrate	5 to 10 minutes
$NaNO_3$	5 to 20 minutes
$NaClO_3$	2 to 30 minutes
NaCN	5 to 7 minutes

The figures given represent the extremes of different observations with wires of varying sensitivity. Passivity is preserved longest in solutions of nitrates and chlorates, but all salts with terminal oxygen in the anion activate slowly. Why cyanide should act similarly is difficult to say; the whole subject should be investigated thoroughly. It is noteworthy that in nitrate solutions no definite relation between concentration and velocity of activation was found; in all of the solutions examined activity appeared only after the lapse of several minutes; and apparently its precise moment of appearance depends largely on casual conditions, especially irregularities in the structure of the metal. The following list gives the minimal times of exposure observed in a series of solutions of $NaNO_3$.

Conc.	Active after
m	10 minutes
$m/2$	4 "
$m/4$	8 "
$m/8$	>10 "
$m/16$	10 "
$m/32$	6 "
$m/64$	6½ "
$m/128$	4 "
$m/256$	>8 "
$m/512$	6 "

In this series the least effective exposure was 4 minutes, and there was no apparent relation to concentration. Not infrequently wires have been found passive after 15 or 20 minutes in solutions of $NaNO_3$. In all probability the structural conditions at the surface of the metal, which in such experiments are determined by casual conditions beyond control, are a main factor determining the precise rate of activation in any instance. An analogy is offered by the case of rusting, the rate of which depends not so much upon the concentration of oxygen and the conductivity of the solution as upon the special character of the metal; this determines the number of local couples to whose electrolytic action the chemical change is chiefly due. Pure and homogeneous specimens of iron rust very slowly, even under the most favorable conditions.[1]

In the above solutions the delay in activa-

[1] *Cf.* Walker, Cederholm and Bent, *Jour. Amer. Chem. Soc.*, 1907, Vol. 29, p. 1251; Lambert, *Jour. Chem. Soc.*, 1910, Vol. 97, *Trans.*, p. 2426, and 1912, Vol. 101, p. 2056; Dunstan and Hill, *ibid.*, 1912, Vol. 99, p. 1835.

tion depends upon the oxidizing properties of the anion. In solutions of alkali salts with anions of still greater oxidizing power, *e. g.*, bichromates and permanganates, passivity is preserved indefinitely. These salts, as well known, are strong passivating agents; a saturated solution of $KMnO_4$ passivates active iron wires with one or two seconds exposure or even less.

The nature of the cation is also an important factor in the activating or passivating action of a salt. Passive wires retain their passivity longer in solutions of heavy metal salts (especially nitrates) than in corresponding solutions of alkali and alkali earth salts. This is well illustrated by copper salts; in *m*/20 $CuCl_2$ activation is rapid (1 to 2 seconds), as in all solutions of chlorides; in *m*/20 $CuSO_4$ it usually requires from 5 to 10 minutes, and in *m*/20 $Cu(NO_3)_2$ more than 30 minutes. A similar relation is seen with acids; *m*/10 HCl activates in less than 1 second; *m*/10 H_2SO_4 requires several minutes; while in *m*/10 HNO_3 passivity is preserved indefinitely. The nitrates of metals with a lower solution-tension than passive iron ($AgNO_3$, $Hg(NO_3)_2$) also preserve passivity indefinitely and their solutions act as strong passivating agents.

In solutions of copper salts the precise activation-time can be measured with accuracy in a single wire if the wire is kept under close observation, for at the moment when activation is complete metallic copper begins to be deposited upon the bright surface of the iron and in a few seconds the original steel-white luster changes to a dull copper-red. A large number of observations have been made on the influence of different conditions (especially presence of organic compounds, oxidizing agents, and salts of noble metals) upon the rate of activation in *m*/20 $CuSO_4$ and $Cu(NO_3)_2$; in such mixed solutions antagonism-effects are well-marked and will be described below.

An interesting feature in the behavior of passive wires in these solutions is that activation (involving as it does the deposition of copper on the iron surface) has a marked influence upon the subsequent behavior of the same wire when it is repassivated and returned to the same solution. Unless the copper coating is removed very completely from such a wire before repassivation, the latter is always found to be distinctly more reactive in the copper salt solution than before, *i. e.*, activation occurs in a much shorter time. My usual procedure in repassivating wires after activation in solutions of copper salts has been to dissolve off the adhering copper with dilute HNO_3 and then wipe the wire carefully with a coarse cloth until everywhere bright and clean before placing in strong HNO_3 for repassivation. But if the copper is imperfectly removed before repassivation (*e. g.*, by simply rubbing the wire with the cloth), and especially if the stay in strong acid is brief, the wire is typically found to become active in the salt-solution within a briefer period than normally. Thus with wires carefully cleaned before passivation, the average time of activation in *m*/20 $CuSO_4$, with 36 trials with different wires, was 11 minutes; while with wires which were passivated with some copper still adhering the average of 31 trials was 3 minutes. In *m*/20 $Cu(NO_3)_2$ the respective times were: carefully cleaned wires, 34.2 minutes; imperfectly cleaned wires, 19.7 minutes (average of 20 trials in each case). Although the two sets of wires have the typical steel luster after passivation and are then indistinguishable in appearance, it is probable that the sensitizing effect of the previous activation is to be referred to the presence of minute particles of copper which remain adhering to the surface of the iron and by acting as anodal regions or nuclei exert upon the general film-covered surface an influence favorable to activation. Under normal conditions the contact of metallic copper activates passive iron; presumably, therefore, the presence of this adhering copper would have the same influence in promoting activation as the simultaneous contact of numerous particles of the metal at different points of the surface; the activation-process is facilitated and occupies a shorter time than before. Activation in a solution of a copper salt thus renders the metal for a time more sensitive to a second

activation—a condition which has many general biological analogies and suggests that the basis for many phenomena of sensitization and memory in organisms may consist in a deposition of specific materials in the surface-films of the sensitive elements. In other words, some specific and lasting change in composition is the direct result of the response to stimulation, and increases the sensitivity to a subsequent stimulation of the same kind.

Antagonisms.—In general any condition that confers increased stability upon the surface-film prevents or retards its destruction in an activating solution and hence preserves passivity. Accordingly strongly oxidizing compounds like peroxides, bichromates, permanganates, osmium tetroxide, salts of noble metals (Hg, Ag, Au, Pt) antagonize the activating effects of sodium nitrate and other salt solutions upon passive iron. The addition of one mol of $AgNO_3$ to 100 mols of $NaNO_3$ in a solution of the latter salt entirely prevents spontaneous activation. The antagonism between Na and Ca salts, however, which is so characteristic of biological systems, is not exhibited by passive iron, or only slightly. It is also difficult to antagonize the activating effect of chlorides; for example, in *m*/60 NaCl the addition of $K_2Cr_2O_7$ to a total concentration of 0.08 m. was found to preserve passivity indefinitely, but 0.04 m. proved insufficient, although it prolonged the time of activation from one or two seconds (the time in pure *m*/60 NaCl) to about 30 seconds.

The activating influence of the Cl-ion is thus counteracted only by a great excess of the oxidizing agent. A less strongly oxidizing salt like $NaNO_3$ has only a slight antagonizing effect with chlorides; thus in a series of mixtures of *m*/50 NaCl and *m*/50 $NaNO_3$ in all proportions, using passive wires which underwent activation in pure *m*/50 NaCl in 2 to 3 seconds, the activation-time was prolonged to only 7 or 8 seconds in a solution containing 1 part NaCl to 4 parts $NaNO_3$, and to 20 or 25 seconds in a solution of 1 part NaCl to 9 parts $NaNO_3$. In the pure *m*/50 $NaNO_3$ activation requires five minutes or more. The prepotent action of the Cl-ion is thus evident.

The action of $AgNO_3$ in solutions of sodium nitrate, chlorate, sulphate or acetate affords a typical instance of ion-antagonism in which the protective effect is due to the cation of the added salt. Many biological antagonisms are of this class. The following brief summary of typical experiments will illustrate. Passive wires were placed in solutions of the four sodium salts named, both pure and with the addition of $AgNO_3$ as indicated.

Solution	Result
Pure *m*/10 $NaNO_3$, $NaClO_3$, Na_2SO_4, or $NaCOOCH_3$	Wires are all active within 30 minutes or less.
99 vols. *m*/10 Na-salt *plus* 1 vol. *m*/10 $AgNO_3$	Wires in $NaNO_3$, $NaSO_4$ and $NaCOOCH_3$ remained passive indefinitely; in $NaClO_4$ they became active in respectively 1 hour, 2½ hours, and 50 minutes in three successive trials.
98, 97 96 and 95 vols. *m*/10 Na-salt *plus*	All wires remained passive indefinitely. (respectively) 2, 3, 4 and 5 vols. *m*/10 $AgNO_4$

Salts of other noble metals (Hg, Au, Pt) similarly prevent spontaneous activation in solutions of $NaNO_3$. Of the two mercuric salts, chloride and nitrate, the former proved ineffective in the three mixed solutions used, viz., 95, 90 and 80 vols, *m*/10 $NaNO_3$ *plus* (respectively) 5, 10 and 20 vols. *m*/10 $HgCl_2$; in these solutions the action of the Cl-ions overbalances that of the Hg-ions; but in corresponding solutions containing $Hg(NO_3)_2$ instead of $HgCl_2$ passivity was preserved indefinitely. Similarly a slight addition of $AuCl_3$ or $PtCl_4$ to *m*/10 $NaNO_3$ prevented spontaneous activation and preserved passivity indefinitely (*e. g.*, 2 or 4 c.c. of a 1 per cent. solution of either salt to 100 c.c. of *m*/10 $NaNO_3$).

It is significant that such salts exhibit protective action only if the metal is nobler than passive iron; similar addition of $Ca(NO_3)_2$, $Pb(^{N}o_3)_2$ or $Cu(NO_3)_2$ to *m*/10 $NoNO_3$ had no such effect. Apparently the metal of the

antagonizing salt must be of such a nature that its contact (as metal) with passive iron promotes passivity rather than activity; thus it is well known that contact of passive iron with copper, lead and other baser metals causes activation, while contact with mercury and the nobler metals has no such effect and indeed promotes passivity. Hence any metallic particles of the former class which may be deposited on the iron surface serve as activating centers (*i. e.*, are anodic relatively to passive iron), while those of the latter class have a reverse or passivating influence. The ability of any cation to prevent activation thus depends upon the electrical potential of the metal in relation to that of the passive iron surface. In other words, the passivating effect is a direct function of the oxidizing potential of the ion in question, *i. e.*, the readiness with which it parts with its positive charge (or receives electrons).

As already shown, the activating effect of the $NaNO_3$ solution is equally well prevented by the addition of small quantities of salts with strongly oxidizing anions, like $K_2Cr_2O_7$ or $KMnO_4$; oxidizing non-electrolytes like H_2O_2 and OsO_4 have a similar influence. Ionic antagonism is thus not a function of the sign of the ionic charge, but of the special chemical—more specifically oxidizing—properties of the ion. Non-electrolytes with similar chemical properties are equally effective. All of these phenomena have parallels in the behavior of living systems.

Pure solutions of $AgNO_3$, $Hg(NO_3)_2$, $K_2Cr_2O_7$ and $KMnO_4$ both preserve passivity and have a rapid passivating action on active iron. An exposure of two or three seconds to *m*/20 $AgNO_3$ or $Hg(NO_3)_2$ is sufficient to confer passivity upon an active wire. The velocity of the passivation-process is high; in a series of experiments with solutions of $AgNO_3$ (*m*/10, *m*/20, *m*/40, *m*/80, *m*/160) it was found that even in the *m*/160 solution an exposure of three seconds was usually sufficient for passivation. Saturated $KMnO_4$ passivates with exposures of one second or less; $K_2Cr_2O_7$ is somewhat slower in its action.

The essential results of experiments with surface-active organic compounds (anæsthetics) can be summarized briefly. *m*/20 $CuSO_4$ was used, containing in solution the compound under examination; the rate of activation was compared with that observed in the pure *m*/20 $CuSO_4$. In general such compounds, unless of a definitely oxidizing chemical character (*e. g.*, nitro compounds or nitrate esters), exhibited little or no effect in either retarding or accelerating activation. The higher aliphatic alcohols, however (n-hexyl, n-heptyl, n-octyl, capryl), had a moderate retarding influence in saturated solution, an effect probably dependent on the viscosity of the adsorbed layer and the lowered electrical conductivity; little effect was found with the lower members of the series. Chloroform, ethyl ether, carbon tetrachloride, ethyl and phenyl urethanes, fatty acid esters (ethyl acetate, propionate and butyrate), chloretone, paraldehyde, chloral hydrate, benzol, naphthalene, phenanthrene, all showed little or no retarding action. On the other hand, ethyl nitrate had a well marked antagonistic effect, in one case prolonging passivity for more than twenty-four hours; nitromethane and acetonitrile also caused distinct retardation. Parallels with the general pharmacological action of the above compounds are thus not apparent in these experiments, but the existence of such parallels is perhaps hardly to be expected. In the living cell the characteristic action of these compounds appears to depend largely upon solution in the organic solvents of the protoplasm, especially the lipoids; the stability of the protoplasmic film is correspondingly altered, being increased at the anæsthetizing concentrations of the compounds. In the metal no such process of solution can occur, and whatever influence is exerted appears to depend upon the physical properties of the adsorbed layer or upon the direct chemical action of the compound upon the metal.

RALPH S. LILLIE

PHILADELPHIA MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE general description of the meeting held September 2 to 6, 1919, has already been printed

in SCIENCE, for September 19. The following is a list of the papers with abstracts in so far as they have been obtained:

GENERAL MEETING

Some problems and methods in agricultural research: H. J. WHEELER.

Some physiological effects produced by radiating definite regions within a single cell: W. V. BOVIE.

Stream pollution and its relation to the chemical industries: EARLE B. PHELPS. Published in full in *Jour. Ind. and Eng. Chem.*, 10 (1919), 928. The relation of stream pollution to the chemical industries is two-fold. Many industries require water supplies of good quality, and most of them produce liquid wastes which, if discharged without treatment into the water courses, tend to pollute those waters. With the growth of industry, and the increasing joint use of streams for the purposes of water supply and waste disposal conflicts of interest are bound to arise.

In most states this matter comes under the administrative activity of the public health officials, who likewise initiate or assist in framing the laws. Manufacturing interests have in the past exerted merely obstructive influence.

Stream pollution and its control involve problems of engineering, chemistry, biology and economics. The first aim is the fixing of standards of permissible pollution which will develop the maximum advantageous use of the streams.

The subject of treatment presents many interesting chemical problems, and its study frequently leads to important recoveries of by-products.

The subject of stream pollution and its control is broader than its legal and remedial phases; its public-health interests or its manufacturing interests; its broader than state jurisdictions. It is a part of the problem of the maximum utilization and development of our waterways. As such it is essentially a Federal problem, calling for extensive investigation and uniform treatment. Its importance should be fully recognized in the creation of any such federal commission as the Interstate Waterways Commission which has recently been suggested.

The building of atoms and the periodic systems: W. D. HARKINS. (To be printed in SCIENCE.)

The chemical laboratory as a publicity factor: ROBERT P. FISCHELIS. See *Jour. Ind and Eng. Chem.*, 10 (1919), 929.

DIVISION OF AGRICULTURAL AND FOOD CHEMISTRY

W. D. Richardson, *Chairman.*

T. J. Bryan, *Secretary.*

What was the diet of aboriginal man? W. D. RICHARDSON.

On the constitution of butterfat: W. D. RICHARDSON.

Some experiments on simple dietaries: W. D. RICHARDSON.

Influence of segregation upon the composition of sugar products: C. A. BROWNE. The author after a brief mention of the uneven distribution of the constituents of different sugar products, such as honey, sirup, sugars, jelly, etc., produced by gravity, capillarity, evaporation and other causes, cites the specific instance of low grade molasses. Top and bottom portions of Cuban molasses, which gave no visible indications of deposits, showed from 2.50 per cent. to nearly 4 per cent. more ash and from 0.25 per cent. to 1.40 per cent. more organic non-sugars in the bottom layers. Similar but less pronounced differences were observed in case of refinery molasses. As a result of the settling out of insoluble salts and gums the top portions of unmixed molasses may be expected to contain more water, sucrose and invert sugar than the bottom portions.

The hydroscopic capacity of certain food constituents: C. A. BROWNE. The moisture-absorbing capacity of levulose agar, gelatin, peptone, bread, cellulose and sucrose are given for different conditions of atmospheric humidity. For ordinary conditions the power of the substances to absorb moisture decreases in the order named. As regards influence of season food products have the least moisture in February and the highest moisture in July and August. The ratio of moisture content to humidity and the influence of lag (due to time of adjustment between surface and interior moisture) are discussed. The rates of absorption for the different substances under constant humidity are given, also a few practical bearings which the results have upon commercial and analytical problems.

The relative importance of some coloring matters in sugar cane juices and syrups: F. W. ZERBAN.

Nutrition experiments with low-cost protein diets with reference to the utilization of peanut and soy bean flours: CARL O. JOHNS, A. J. FINKS and MABEL S. PAUL.

The amount and distribution of iron in the corn plant: G. N. HOFFER, R. H. CARR and I. L. BALDWIN.

Chemical changes in cranberries during storage: FRED. W. MORSE. There are small but positive differences in the percentages of sugar and acid contained in different varieties of cranberries. The maximum of sugar is present soon after picking. During storage the sugar slowly diminishes as the berry makes use of it in maintaining its life processes. The rate of change is much accelerated by a rise in temperature and is most pronounced when the fruit is kept in tight, unventilated packages. Acid remains as a rule unchanged.

Respiration of cranberries: FRED W. MORSE. A simple method of estimating the rate of chemical changes in fruit at a given temperature, is to determine the amount of CO_2 exhaled by a kilogram of the fruit in an hour. The CO_2 is produced by the oxidation of some of the soluble carbonaceous matter in the fruit's cells, hence the rate of metabolism may be closely estimated. The experiments showed that cranberries exhaled twice as much CO_2 at 10° C. as at 1° and that the rate doubled again at 20°. The nearer the freezing-point, fruits are held before they are consumed, the more nearly will their quality remain like freshly picked fruit. A week at summer temperature will be as destructive to quality as a month in cold storage.

The cause of deterioration and spoiling of corn and corn meal: J. S. MCHARGUE.

The water soluble manganese of soils: W. O. ROBINSON, R. F. GARDINER and R. S. HOLMES. The results obtained by frequently shaking 24 samples of soil with distilled water for eight days are given in this paper.

The following deductions are drawn from the data: (1) One hundredth to .1 of the total manganese of soils is soluble in water. (2) Carbon dioxide greatly increases the solubility of the manganese. (3) Surface soils contain much more soluble manganese than subsoils, the difference is greater the finer the texture of the soil. (4) The amount of MnO in soil extracts varies from 0–24 parts per million and is large enough to affect the bacteriological flora and probably has a more direct influence on plant growth.

The composition of ultra clay from certain soils: W. O. ROBINSON. By the term "ultra clay" is meant that body which remains in nearly permanent suspension when the soil is treated with pure water. It has no organized structure and behaves as any colloid. It is essentially an extremely finely divided hydrous aluminum silicate, with some of the aluminum replaced by iron. Hydrated oxides of aluminum, iron, titanium, silicon and manganese (probably) are also present. The phosphoric acid and potash of ultra clays is higher than the soil from which they were obtained. Organic matter is an ever present constituent and it is probable that it plays an important part in deflocculating the suspension.

Composition of soil extracts: M. S. ANDERSON and W. H. FRY. The salts deposited on the evaporation of the water extract of soils are much more complex in character than is indicated by a simple statement of the ions existing in solution. There is a marked general similarity between the salts obtained on evaporation of water extracts of soils and those obtained by both natural and artificial evaporation of sea-water. No salt can be expected to furnish all the salts occurring in natural deposits of saline material because these represent crystallization from a composite extract. Under ordinary soil conditions these complex salts are probably always in solution in the soil moisture.

Melezitose in honey: EDGAR T. WHERRY. Melezitose is a rare sugar, a trisaccharide, which has heretofore been but little known. Its name is from melez, the French name for the larch tree, it having been discovered in a honey dew on the European larch. It also occurs in manna, a sugary incrustation, on a leguminous tree in Persia and adjoining countries. Its occurrence in a similar material found on the Douglas fir in British Columbia has been recently described by Hudson and Sherwood.[1] While the latter occurrence was under investigation, some honey received from central Pennsylvania was found to be nearly solid from the crystallization of the same sugar; and Dr. C. S. Hudson asked the writer to visit the regions where this honey was produced, and endeavor to ascertain the origin of the melezitose. After considerable study, the following origin of this substance was worked out: The scrub pine tree, and rarely other species of pine, are subject to attack by a plant louse—of the group known technically as lachnids—and a scale insect of the group known as coccids. These insects develop in midsummer in considerable numbers, and in the course of their life activities excrete a sweet material, honey-dew, which is rich in melezitose. In dry summers, after the white clover flowers have ceased to yield honey, the bees turn to this honey dew, and collect it, but it crystallizes as fast as they store it away,

[1] *J. Am. Chem. Soc.*, 40, 1456 (1919).

making the honey unattractive in appearance, and if stored in cells to be used by the bees during the winter, disastrous to the bee keepers; for during the cold weather the bees can not get water to dissolve the crystals, and starve. This occurred in 1917 and 1918, and considerable losses were suffered by the bee-keepers from this cause. But in the present year the weather was so moist during July that no melezitose was collected by the bees at all. Several kilograms of this rare sugar have been extracted from honey and purified in the Bureau of Chemistry, so that it is now available for thorough investigation of its properties. It can be readily distinguished from glucose by observation of the crystals in the honey with the polarizing microscope.

Milk with high apparent acidity: Frank E. Rice. Individual cows were found giving milk with titratable acidities as high as .22 per cent. Several tests were applied to this type of milk as well as to normal milk both fresh and sour. The results were as follows: (1) Formaldehyde titration indicated that where high casein was present, high apparent acidity might be expected. On the other hand, some samples were found with high apparent acidity which were not unusually high in casein. (2) Titration by the Van Slyke oxalate procedure indicated that phosphates were always somewhat higher in this class of milk. (3) Electrometric and colorimetric methods showed the hydrogen ion concentration to be similar to that of normal fresh milk. (4) Electrical conductivity was no higher than in normal milk. (5) Methylene blue and alcohol tests were always negative. (6) High solids and solids-not-fat usually but not always accompanied high apparent acidity. (7) This condition was always found in the early stages of lactation but occasionally also in late stages. (8) Observation did not indicate that feeds were a factor in causing high apparent acidity.

Effects of sulphur in manure-phosphate composts: W. E. Tottingham. Sulphur and rock-phosphate have been composted with manure, both separately and together. Analysis after four months of fermentation has shown the production of high titratable acidity where sulphur was present, with consequent increases of citrate-soluble P_2O_5 where rock-phosphate was also present. Application of these composts to pure sand, together with nutrient salts, to sandy soil and to silt loam for greenhouse cultures of barley has led to increased yields of seed from the sulphur-phosphate compost, as compared with the compost of phosphate alone. Similar results have followed the application of sulphur and rock phosphate to field plots of barley in unmanured sandy loam. The peculiar, outstanding feature of the results has been that sulphur alone has shown as great seed producing power as the combination of sulphur with rock-phosphate, under these conditions.

The quantities of preservatives necessary to inhibit and prevent alcoholic fermentation and the growth of molds: Margaret C. Perry and George D. Beal. Sterile dextrose broth, to which known quantities of preservative had been added, were inoculated with pure cultures of *Sacc. cerevisiæ* and *P. glaucum*. The tubes were incubated at room temperature until positive results were obtained in check tubes. In case of no gas formation or of failure to obtain a visible growth of mold, dextrose agar plates were poured to determine the point at which complete sterilization took place.

Shark meat as an edible product: Allen Rogers. This paper deals with the use of shark meat as a food product and shows that it would be possible to secure approximately 200,000 pounds of this material daily or 75,000,000 pounds annually. Assuming that the market price could be set at 10 cents it shows that at the present time we are wasting a food product with a value of $7,300,000. The edible portion of the shark consists of about 50 per cent. of the weight of the body and resembles in its texture and flavor either the halibut or sword fish. In some markets this product is now being sold under the name of deep sea sword fish and a certain species of shark known as dog fish is being canned and labelled grey fish. Cooking experiments have shown the food to be very palatable and nourishing.

Charles L. Parsons,
Secretary

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